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(54) METAL-FORMING

(71) We, STEVENS & BULLIVANT LIMITED, a British Company, of Western Road, Birmingham 18, in the County of Warwick, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the forming of a square shoulder around the external periphery of metal tubing.

Where metal tubes are to be connected together in telescoping relation, for example as in scaffolding, it is common practice to form one tube with a reduced diameter end portion and a radiussed shoulder at the junction between said end portion and the remainder of the tube whereby said end portion may be inserted into a second tube up to a distance governed by the radiussed shoulder. In scaffolding, the radiussed shoulder is arranged to be load supporting and has been found to be unsatisfactory when subjected to large loads in that creep may occur between the telescopically connected tubes due to the radiussing of the shoulder.

For this reason, there is a requirement for scaffolding tubes to be formed with square shoulders to eliminate the problem of creep.

An object of the invention is to provide a method of forming round-section metal tube with a square shoulder around the periphery thereof without entailing a large number of forming operations.

According to the invention we provide a method of forming a square shoulder around the external periphery of a round section metal tube, said method comprising cold-working an end portion of the round section metal tube to reduce the diameter thereof and provide the same with a uniformly-tapering portion, heating said end portion of the tube and applying an impact axially to said tapering portion through the agency of a flywheel-driven crank carrying a forming die, said die having a die cavity comprising an axial bore for reception of a leading part of said end portion and a circumferential right-angled rebate for cooperation with said tapering portion to displace the material thereof to form a square shoulder on the tube.

Preferably the tapering portion is so formed that it is inclined at an angle of between 14° and 18° with respect to the axis of the tube. Where the tapering portion is inclined more steeply than the specified range, it has been discovered that a region of said end portion in the immediate vicinity of the formed square shoulder tends to neck thereby giving rise to a potential source of weakness if the tube is subjected to heavy loading. If the tapering portion is formed with a shallower inclination then the quantity of material required to undergo deformation may be too great to provide a satisfactory square shoulder.

The cold working step is preferably carried out by rotary swaging in which the tube end portion is subjected to a series of forming operations effected by successive sets of dies, each set defining a progressively smaller die cavity.

The invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a sectional view of a tube after the same has been tapered at one end thereof;

Figures 2 and 3 are sectional views showing successive stages in the forming of a square shoulder around said tapered end of the tube by means of a die; and

Figure 4 is a front elevation of a press including the die and showing the tube mounted thereon.

Referring [illegible]gure 1, a mild steel metal tube 10 having a nominal bore size of, for example, 1½ inches and an outside diameter of 1.29-32 inches is subjected to a rotary swaging operation in which one end portion of the tube is reduced in diameter so as to have a leading section 12 of uniform outside diameter of 1¼ inches and a uniformly tapering section 14 having an inclination of A, between 14° and 18°, preferably 16° with respect to the axis of the tube.

As seen in Figure 4, the swaged tube is fixedly clamped horizontally on the bed of a press by means of clamps 16, with the leading section 12 thereof presented towards an axially reciprocable forming die 18. The sections 12 and 14 are then heated preparatory to being subjected to a forming operation by the die. The die comprises a first elongate bore 20 of diameter sufficient to receive the leading section 12 of the tube with clearance (see Figure 2) and a second bore 21 which together with bore 20 provides a right-angled rebate 22 at the junction therebetween such that, during advance of the die 18 axially on the tube 10, the material of the heated tapering section is displaced so as to fill the rebate 22 to form a square section shoulder on the tube. During this operation, the tapering section 14 of the tube is deformed by the die cavity so as to have a uniform diameter corresponding to the diameter of the leading section 12.

The drive means for the die 18 comprises a crank (not shown) driven from a motor through the agency of a flywheel 26 rotatably fast with the crank whereby the impact received by the stationary tube is of very short duration and is not accompanied by any significant cooling of the tube during the forming operation.

Typically, the stroke of the die is 8" and an impact of 60 tons is applied by the press during the working stroke of the die.

WHAT WE CLAIM IS:—

1. A method of forming a square shoulder aro[illegible]e external periphery of a round section metal tube, said method comprising cold-working an end portion of the round section metal tube to reduce the diameter thereof and provide the same with a uniformly-tapering portion, heating said end portion of the tube and applying an impact axially to said tapering portion through the agency of a flywheel-driven crank carrying a forming die, said die having a die cavity comprising an axial bore for reception of a leading part of said end portion and a circumferential right-angled rebate for co-operation with said tapering portion to displace the material thereof to form a square shoulder on the tube.

2. A method according to Claim 1 wherein the tapering portion is so formed that it is inclined at an angle of between 14° and 18° with respect to the axis of the tube.

3. A method according to Claim 2 wherein said angle is 16°.

4. A method according to any one of Claims 1-3 wherein said end portion of the finished tube is provided with a leading section of uniform outside diameter less than the diameter of the remainder of the tube.

5. A method according to any one of Claims 1-4 wherein the cold working of said end portion of the tube is effected by rotary swaging.

6. A method of forming a square shoulder around the external periphery of a round section metal tube, substantially as hereinbefore described with reference to the accompanying drawings.

7. A round-section metal tube having a square shoulder around the external periphery thereof formed by the method of any one of Claims 1-6.

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2 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

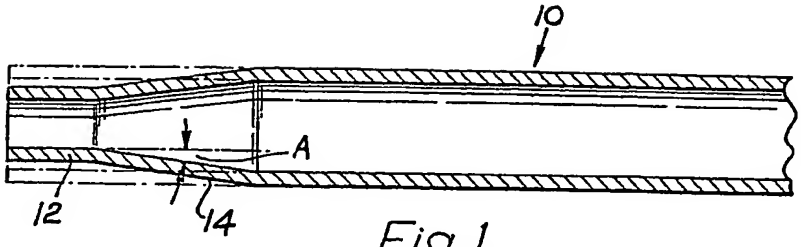

Fig. 1.

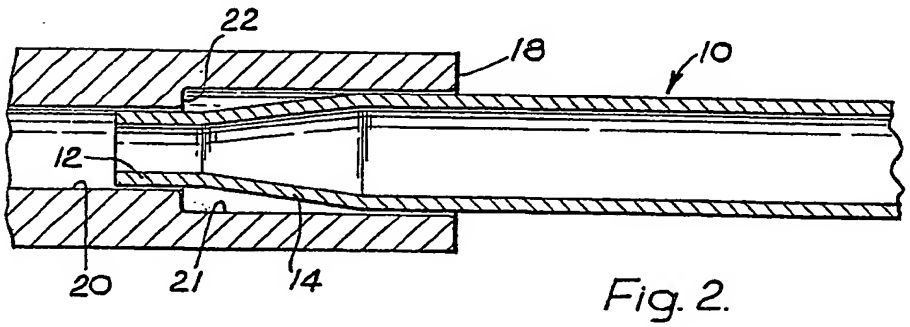

Fig. 2.

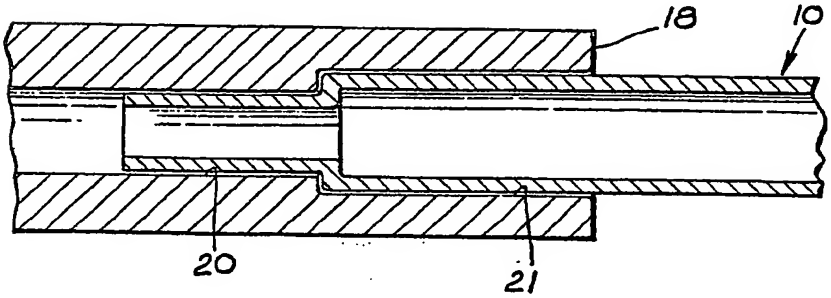

Fig. 3.

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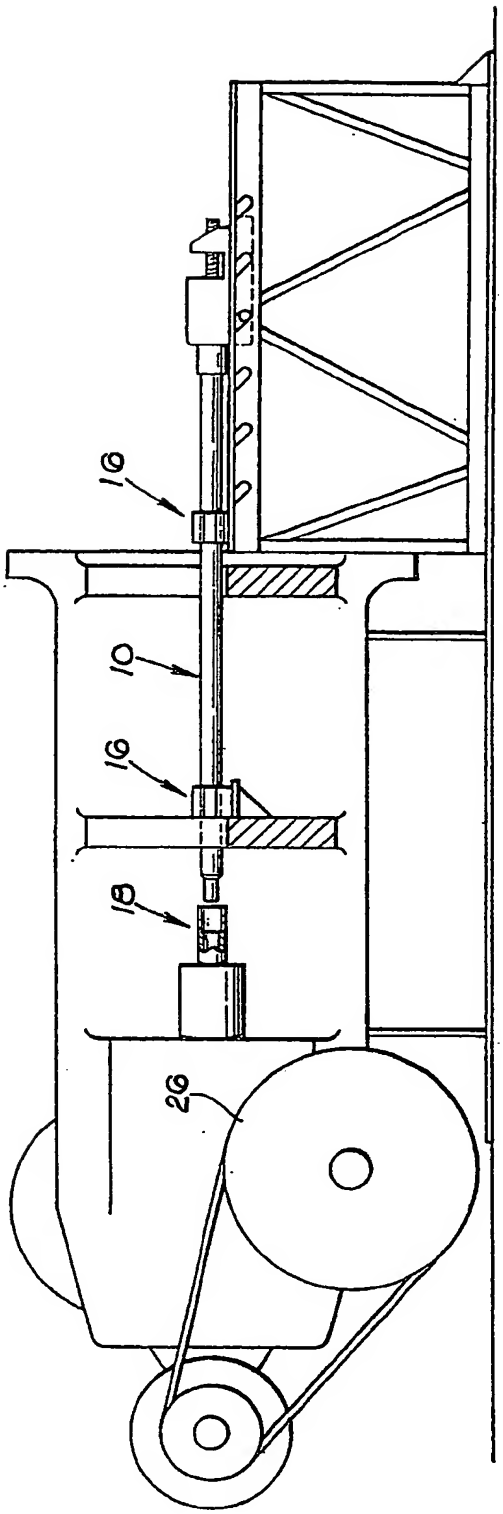

Fig. 4.